Summit® X450e Series

Summit X450e — The industry's first PoE edge switches with the revolutionary modular operating system, ExtremeXOS™.

Voice-Class Availability

- Modular ExtremeXOS operating system
- Ethernet Automatic Protection Switching (EAPS) resiliency protocol
- Resilient system design

Designed for Converged Network Applications

- High bandwidth, non-blocking architecture for demanding edge applications
- Exceptional Quality of Service (QoS) with advanced traffic management capabilities for converged applications
- Convergence ready connectivity with Voice over IP automatic provisioning
- Efficient management to handle convergence-driven network changes with Power over Gigabit Ethernet

Comprehensive Security Enabling Defense-in-Depth

- User policy and host integrity enforcement
- Universal Port dynamic security profile to provide fine granular security policy in the network
- Detection and response to network intrusion
- Policy-based selective encryption with Sentriant™ CE150

Summit X450e switch is an industry-leading converged Gigabit Ethernet PoE edge switch with ExtremeXOS modular operating system and optional dual 10 Gigabit Ethernet ports.

Summit X450e series switches are based on the revolutionary ExtremeXOS core-class operating system from Extreme Networks®. ExtremeXOS is a highly resilient, modular operating system that provides continuous uptime, manageability and operational efficiency.

Summit X450e provides high availability and performance with its advanced traffic management capabilities to support large scale rollout of converged network that supports devices such as IP telephones, wireless APs and other devices that require power from a LAN connection. With low-latency line-rate performance, Summit X450e supports the 802.3af standards-based PoE on every port.

Summit X450e supports hardware-based routing for both IPv4 and IPv6 to help provide investment protection by allowing the rollout of IPv6 in your network now or in the future.

The highly flexible Summit X450e switch provides high-density gigabit plus optional 10 Gigabit Ethernet ports in a compact 1RU format, supporting a full range of Layer 2 to Layer 4 functionalities on every port for high productivity. Optional redundant power supplies are provided with each switch to secure against power

Target Applications

- Edge PoE switch providing high-density Gigabit PoE to the desktop in a network running ExtremeXOS from the core to the edge

Voice-Class Availability

Powered by ExtremeXOS, the Summit X450e switch supports process recovery and application upgrades without the need for a system reboot. Summit X450e provides the high network availability required for converged applications.

Modular Operating System for Non-Stop Operation

True Preemptive Multitasking and Protected Memory

Summit X450e switches allow each of the many applications—such as Open Shortest Path First (OSPF) and Spanning Tree Protocol (STP)—to run as separate Operating System (OS) processes that are protected from each other. This drives increased system integrity and inherently protects against Denial of Service (DoS) attacks.

Process Monitoring and Restart

ExtremeXOS dramatically increases network availability using process monitoring and restart. Each independent OS process is monitored in real time. If a process becomes unresponsive or stops running, it can be automatically restarted.

Loadable Software Modules

The modular design of ExtremeXOS allows the upgrading of individual software modules, should this be necessary, leading to higher availability in the network (see Figure 1).

High Availability Network Protocols

Ethernet Automatic Protection Switching (EAPS)

EAPS allows the IP network to provide the level of resiliency and uptime that users expect from their traditional voice network. EAPS is superior to Spanning Tree or Rapid Spanning Tree protocols and offers sub-second (less than 50 milliseconds) recovery that delivers consistent failover regardless of the number of VLANs, network nodes or network topology. Since EAPS allows the network to recover almost transparently, Voice-over-IP (VoIP) calls do not drop and digital video feeds do not freeze or pixelize in most situations.

Spanning Tree/Rapid Spanning Tree Protocols

Summit X450e switches support Spanning Tree (802.1D), Per VLAN Spanning Tree (PVST+), Rapid Spanning Tree (802.1w) and Multiple Instances of Spanning Tree (802.1s) protocols for Layer 2 resiliency.

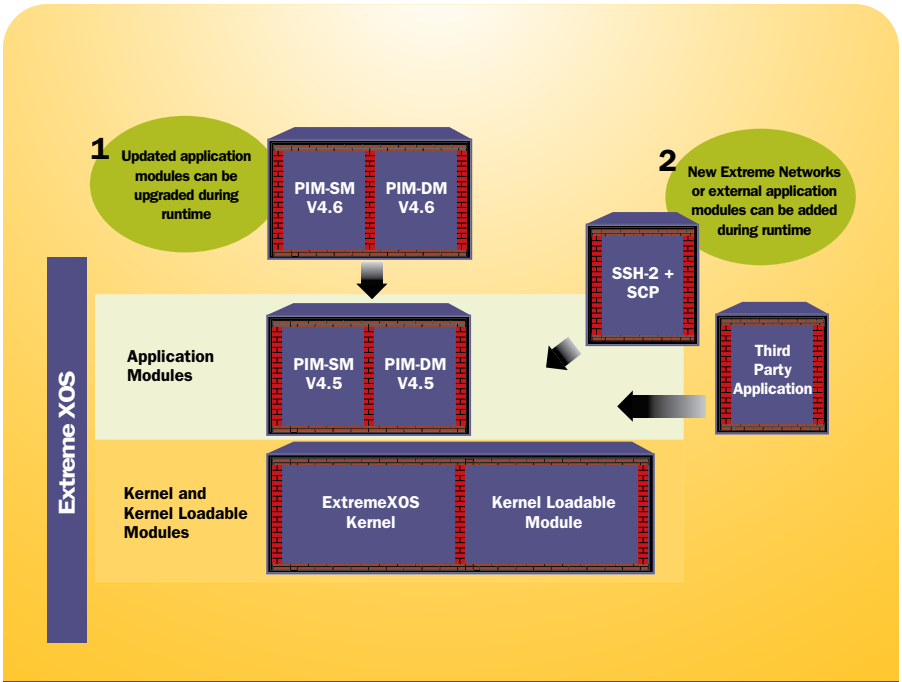

Figure 1: ExtremeXOS Modular Design

Software-Enhanced Availability

Software-enhanced availability allows users to remain connected to the network even if part of the network infrastructure is down. Summit X450e switches continuously check for problems in the uplink connections using advanced Layer 3 protocols such as OSPF, VRRP and ESRP (ESRP supported in Layer 2 or Layer 3), and dynamically routes traffic around the problem.

Equal Cost Multipath Routing

Equal Cost Multipath (ECMP) routing allows uplinks to be load balanced for performance and cost savings while also supporting redundant failover. If an uplink fails, traffic is automatically routed to the remaining uplinks and connectivity is maintained.

Link Aggregation (802.3ad)

Cross module link aggregation allows trunking of up to eight links on a single logical connection, for up to 20 Gigabits per Second (Gbps) of redundant bandwidth per logical connection.

Resilient System Design

Protected Data and OS for Availability

Summit X450e is designed with Error Checking and Correcting (ECC) RAM to protect routing tables and continues to operate in spite of potentially disruptive memory events. Furthermore, the system is designed with enough durable flash memory to maintain dual OS images as well as two copies of configuration files. This provides an added layer of protection against potential crippling disruptions.

Redundant Uplink Bandwidth

Summit X450e offers optional dual 10 gigabit uplinks to provide 20 Gbps uplink bandwidth. Depending on requirements, full failover resilient links can be supported at Layer 2 with 802.3ad link aggregation, or Layer 3 with OSPF ECMP. Common deployments may call for 2.4:1 oversubscription, for which Summit X450e delivers superior resiliency by using the EAPS protocol.

Redundant Power Supplies

Summit X450e provides redundant power externally and offers a convenient and easy to upgrade in-field option to protect against power anomalies.

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Designed for Converged Network Applications

Summit X450e provides a high bandwidth, non-blocking architecture with tri-speed copper Gigabit Ethernet ports with PoE for demanding edge applications. Combining exceptional QoS and advanced traffic management with superior resiliency, comprehensive security and nonblocking performance, Summit X450e switches are the cornerstone of a high-performance converged network.

High Bandwidth, Non-Blocking Architecture for Demanding Edge Applications

When deployed as an access switch, Summit X450e, with its modular 10 gigabit integrated fiber gigabit ports, provides the bandwidth required by the most demanding applications. With more than 20 gigabits of uplink capacity, bottlenecks don't exist. Providing linerate throughput and supporting of jumbo frames up to 9,216 bytes, transfers are completed in minimal time.

Exceptional Policy-based QoS with Advanced Traffic Management for Converged Applications

Summit X450e provides eight hardware queues per port to support granular traffic classification with bandwidth allocation. 1024 centralized classifiers per switch can use information from Layers 1 through 4 to prioritize and meter incoming packets at line-rate. When metering traffic, the switches can drop out-of-spec traffic or flag it for later action. To expedite upstream traffic handling, a packet's classification can be carried forward with Layer 2 (802.1p) and Layer 3 (DiffServ) markings. Summit X450e provides advanced traffic management features that offer highest-quality triple play of voice, video and data services.

Efficient Management to Handle Convergence-Driven Network Changes

Universal Port—Voice-over-IP Auto Provisioning

Summit X450e sets the stage for convergence applications by allowing enterprises to add new access devices in a non-disruptive Plug-and-Play fashion. Voice and wireless services can be easily implemented without major network upgrades. Summit X450e supports automatic provisioning of Voice over IP using LLDP and event based command scripting capability. It allows dynamic configuration of voice VLANs and Quality of Services. This auto configuration capability allows you to configure VoIP phone settings such as voice VLAN settings, call server IP address configuration, etc. This level of simplicity in managing network changes will greatly reduce operating expenses.

Power Over Gigabit Ethernet

Deployments of IP Telephony depend on reliable consistent power from the Ethernet jack. Summit X450e is the basis for a reliable LAN telephony infrastructure with fully redundant 15.4 watts per port, and QoS and resiliency to match the failover requirements for latency-sensitive services like VoIP phones. With Summit X450e, deployment of powered LAN devices is quick and easy with its support of the IEEE 802.3af standard and full Class 3 power availability on all ports, backed up 100% by the EPS-LD redundant power supply (Summit X450e-24p). Summit X450e-48p can provide up to 370W of PoE power and can be increased up to 740W of PoE power to provide full 15.4W class 3 devices on all 48-port by adding External Power System (EPS-C and EPS-600LS).

Voice Grade Connections

Granular QoS, low latency, and low jitter enable voice quality connections. Summit X450e supports a range of QoS technologies that can prioritize and predictably handle high priority traffic-policing or rate limiting on ingress, 802.1q tagging and DiffServ marking, and shaping on egress with eight queues per port. The Extreme Networks tradition of building products with low latency and jitter continues with Summit X450e—allowing network managers to build networks with low end-to-end latency and jitter.

Universal Access Port

Summit X450e offers the Universal Access Port—high-performance gigabit to the desktop, PoE and wireless support from every RJ-45 port. Installing universal services ports everywhere for data and device power greatly simplifies installations and moves, and helps to future-proof your edge network. Summit X450e provides universal attachment at any desktop Ethernet speed, any power level from none to full 15.4 watts.

Advanced Routing Capabilities for the Edge

Summit X450e supports advanced protocols for an efficient and productive network. Summit X450e switches provide static and RIP routing for simple IPv4 and IPv6 Layer 3 deployment. An optional ExtremeXOS Advanced Edge license extends the feature set to include other important edge functions such as:

- Edge OSPF for much greater extensibility than RIP can provide
- Edge PIM sparse modes for routing of multicast streams
- Policy-based routing
- sFlow hardware sampling

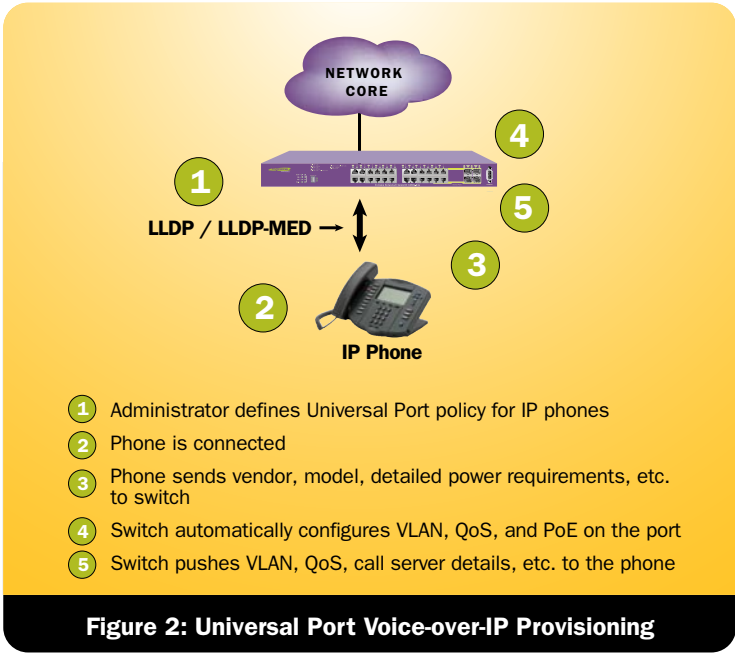
NETWORK CORE
1
LLDP / LLDP-MED
2
3
4
5
IP Phone
1 Administrator defines Universal Port policy for IP phones
2 Phone is connected
3 Phone sends vendor, model, detailed power requirements, etc. to switch
4 Switch automatically configures VLAN, QoS, and PoE on the port
5 Switch pushes VLAN, QoS, call server details, etc. to the phone

Figure 2: Universal Port Voice-over-IP Provisioning

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Comprehensive Security Using Defense-in-Depth

Implementing a secure network means providing protection at the network perimeter as well as the core. Working together with the Sentriant™ family of products from Extreme Networks, Summit X450e uses a defense-in-depth strategy in protecting your network from known or potential threats. Extreme Networks security offerings encompass three key areas: user and host integrity, threat detection and response, and hardened network infrastructure. Furthermore, with policy-based routing, measures can be taken to provide confidentiality of selective data in transit between internal network nodes.

User Authentication and Host Integrity Checking

Network Login and Dynamic Security Profile

Network Login capability implemented in ExtremeXOS enforces user admission and usage policies. Summit X450e series switches support a comprehensive range of Network Login options by providing an 802.1x agent-based approach, a web based (agent-less) login capability for guests, and a MAC-based authentication model for devices. With these modes of Network Login, only authorized users and devices can connect to the network and be assigned to the appropriate VLAN. The Universal Port scripting framework available in Summit X450e lets you implement Dynamic Security Profiles which in sync with Network Login allows you to implement fine grained and robust security policies. Upon authentication, the switch can load dynamic ACL/QoS for a user or group of users, to deny/allow the access to the application servers or segments within the network.

Multiple Supplicant Support

Shared ports represent a potential vulnerability in a network. Multiple supplicant capability on a switch allows it to uniquely authenticate and apply the appropriate policies and VLANs for each user or device on a shared port.

Multiple supplicant support secures IP Telephony and wireless access. Converged network designs often involve the use of shared ports.

Media Access Control (MAC)

MAC lockdown secures printers, wireless APs and servers. The MAC address security/lockdown feature allows Summit X450e to block access to any Ethernet port when the MAC address of a station attempting to access the port is different from the configured MAC address. This feature is used to "lock down" any device to a specific port.

Host Integrity Checking

Host integrity checking helps keep infected or non-compliant machines off the network. Summit X450e series switches support a host integrity or endpoint integrity solution that is based on the model from the Trusted Computing Group. Summit X450e interfaces with Sentriant AG, endpoint security software from Extreme Networks, to verify that each endpoint meets the security policies that have been set and quarantines those that are not in compliance.

Network Intrusion Detection and Response

Hardware-based sFlow Sampling

sFlow is a sampling technology that provides the ability to continuously monitor application level traffic flows on all interfaces simultaneously. The sFlow agent is a software process that runs on Summit X450e and packages data into sFlow datagrams that are sent over the network to an sFlow collector. The collector gives an up-to-the-minute view of traffic across the entire network, providing the ability to troubleshoot network problems, control congestion and detect network security threats.

Port Mirroring

To allow threat detection and prevention, Summit X450e supports many-to-one port mirroring. This allows the mirroring of traffic to an external network appliance such as an intrusion detection device for trend analysis or for utilization by a network administrator for diagnostic purposes.

Line-Rate ACLs

ACLs are one of the most powerful components used in controlling network resource utilization as well as protecting the network. Summit X450e supports 1,024 centralized ACLs per 24-port based on Layer 2, 3 or 4-header information such as the MAC or IP source/destination address.

Denial of Service Protection

Summit X450e effectively handles DoS attacks. If the switch detects an unusually large number of packets in the CPU input queue, it will assemble ACLs that automatically stop these packets from reaching the CPU. After a period of time, these ACLs are removed, and reinstalled if the attack continues. ASIC-based LPM routing eliminates the need for control plane software to learn new flows, allowing more network resilience against DoS attacks.

Secure Management

To prevent management data from being intercepted or altered by unauthorized access, Summit X450e supports SSH2, SCP and SNMPv3 protocols. The MD5 hash algorithm used in authentication prevents attackers from tampering with valid data during routing sessions.

Policy-based Selective Encryption

Sufficient data suggests that insiders account for more than 50% of security breaches. Summit X450e supports policybased routing, a mechanism that allows isolation and protection of data based on department, user group or application via encryption.

Policy-based routing uses ACLs to redirect packets away from their normal path to another physical switch port. Packets can be selected based on their ACL match conditions such as CoS, VLAN, IP address, protocol or port number. Traffic that contains sensitive information such as VoIP phone conversations or email can be routed to an encryption appliance before passed on to its destination.

Summit X450e seamlessly integrates with Extreme Networks Sentriant CE150 that delivers encryption of sensitive information at a gigabit rate.

IPv6 Hardware Forwarding

For more than a decade, a new version of the ubiquitous Internet Protocol (IP) that powers global network interconnectivity has been under development, with the primary goal of expanding IP's address range to allow a unique IP address for any device in the world that might some day need to be addressable. Summit X450e series switches offer this next generation IPv6 routing in hardware to provide wire speed routing capability in IPv4/IPv6 dual stack environment.

ExtremeXOS on Summit X450e delivers more than just IPv6 hardware forwarding; it provides the power to control undesired IPv6 traffic to assure network uptime in the presence of IPv6. Summit X450e series switches help provide investment protection by allowing the rollout of IPv6 in your network now or in the future, when needed.

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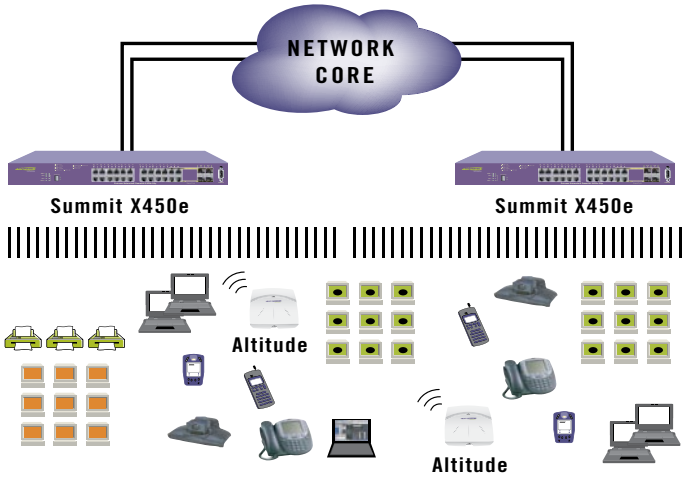
Target Applications

Edge PoE Switch for High-Bandwidth Applications

Summit X450e is deployed as PoE edge switch, extending the benefits of the ExtremeXOS operating system to the network edge. This uniformity provides consistent quality and performance throughout your converged network while eliminating operational inefficiencies. With low latency and line-rate performance, Summit X450e edge switch connects wireless devices, LAN telephony, PDAs and other equipment without compromising security, scalability, availability, mobility or management.



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Technical Specifications

ExtremeXOS V11.6 Supported Protocols

Switching
- RFC 3619 Ethernet Automatic Protection Switching (EAPS) and EAPSv2
- IEEE 802.1D – 1998 Spanning Tree Protocol (STP)
- IEEE 802.1D – 2004 Spanning Tree Protocol (STP and RSTP)
- IEEE 802.1w – 2001 Rapid Reconfiguration for STP, RSTP
- IEEE 802.1Q-2003 (formerly IEEE 802.1s) Multiple Instances of STP, MSTP
- EMISTP, Extreme Multiple Instances of Spanning Tree Protocol
- PVST+, Per VLAN STP (802.1Q interoperable)
- Extreme Standby Router Protocol (ESRP)
- IEEE 802.1Q – 1998 Virtual Bridged Local Area Networks
- IEEE 802.3ad Static load sharing configuration and LACP based dynamic configuration
- IEEE 802.1AB – LLDP Link Layer Discovery Protocol
- LLDP Media Endpoint Discovery (LLDP-MED), ANSI/TIA-1057, draft 08
- Extreme Discovery Protocol (EDP)
- Extreme Loop Recovery Protocol (ELRP)
- Extreme Link State Monitoring (ELSM)
- Software Redundant Ports

VLANs, vMANs
- IEEE 802.1Q VLAN Tagging
- IEEE 802.1v: VLAN classification by Protocol and Port
- Port-based VLANs
- Protocol-based VLANs
- Multiple STP domains per VLAN
- IEEE 802.1ad Virtual MANs (vMANs)

Quality of Service and Policies
- IEEE 802.1D – 1998 (802.1p) Packet Priority
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2475 DiffServ Core and Edge Router Functions

IPv4
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1519 CIDR
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1122 Host Requirements
- RFC 768 UDP
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 894 IP over Ethernet
- RFC 1027 Proxy ARP
- RFC 2068 HTTP server – Used for web-based Network Login
- RFC 2338 VRRP
- Static Unicast Routes
- Static Multicast Routes
- RFC 1058 RIP v1
- RFC 2453 RIP v2
- RFC 2328 OSPF v2 (including MD5 authentication)
- RFC 1587 OSPF NSSA Option
- RFC 1765 OSPF Database Overflow
- RFC 2370 OSPF Opaque LSA Option
- RFC 3623 OSPF Graceful Restart
- RFC 1112 IGMP v1
- RFC 2236 IGMP v2
- RFC 3376 IGMP v3
- IGMP v1/v2/v3 Snooping with Configurable Router Registration Forwarding
- IGMP Filters
- Static IGMP Membership
- Multicast VLAN Registration
- RFC 2362 PIM-SM
- RFC 3569, draft-ietf-ssm-arch-06.txt PIM-SSM PIM Source Specific Multicast

IPv6
- RFC 2460, Internet Protocol, Version 6 (IPv6) Specification
- RFC 2461, Neighbor Discovery for IP Version 6, (IPv6)
- RFC 2462, IPv6 Stateless Address Auto configuration – Router Requirements
- RFC 2463, Internet Control Message Protocol (ICMPv6) for the IPv6 Specification
- RFC 2464, Transmission of IPv6 Packets over Ethernet Networks
- RFC 2465, IPv6 MIB, General Group and Textual Conventions
- RFC 2466, MIB for ICMPv6
- RFC 1981, Path MTU Discovery for IPv6, August 1996 – Router requirements
- RFC 3513, Internet Protocol Version 6 (IPv6) Addressing Architecture
- RFC 3587, Global Unicast Address Format
- RFC 2710, IPv6 Multicast Listener Discovery v1 (MLDv1) Protocol
- RFC 3810, IPv6 Multicast Listener Discovery v2 (MLDv2) Protocol
- RFC 2080, RIPng
- RFC 2893, Configured Tunnels
- RFC 3056, 6to4
- Static Unicast routes for IPv6
- Telnet server over IPv6 transport
- SSH-2 server over IPv6 transport
- Ping over IPv6 transport
- Traceroute over IPv6 transport

Management and Traffic Analysis
- RFC 2030 SNTP, Simple Network Time Protocol v4
- RFC 854 Telnet client and server
- RFC 783 TFTP Protocol (revision 2)
- RFC 951, 1542 BootP
- RFC 2131 BOOTP/DHCP relay agent and DHCP server
- RFC 1591 DNS (client operation)
- RFC 1155 Structure of Mgmt Information (SMIv1)
- RFC 1157 SNMPv1
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB & TRAPs
- RFC 1573 Evolution of Interface
- RFC 1650 Ethernet-Like MIB (update of RFC 1213 for SNMPv2)
- RFC 1901 – 1908 SNMP v2c, SMIv2 and Revised MIB-II
- RFC 2570 – 2575 SNMPv3, user based security, encryption and authentication
- RFC 2576 Coexistence between SNMP Version 1, Version 2 and Version 3
- RFC 1757 RMON 4 groups: Stats, History, Alarms and Events
- RFC 2021 RMON2 (probe configuration)
- RFC 2668 802.3 MAU MIB
- RFC 1643 Ethernet MIB
- RFC 1493 Bridge MIB
- RFC 1354 IPv4 Forwarding Table MIB
- RFC 2737 Entity MIB v2
- RFC 2233 Interface MIB
- RFC 1354 IP Forwarding Table MIB
- RFC 1724 RIPv2 MIB
- RFC 1850 OSPFv2 MIB
- draft-ietf-pim-mib-v2-o1.txt
- RFC 2787 VRRP MIB
- Draft-ietf-bridge-rstpmib-03.txt – Definitions of Managed Objects for Bridges with Rapid Spanning Tree Protocol
- Secure Shell (SSH-2) client and server
- Secure Copy (SCP-2) client and server
- Secure FTP (SFTP) server
- sFlow version 5
- Configuration logging
- Multiple Images, Multiple Configs
- BSD System Logging Protocol (SYSLOG), with Multiple Syslog Servers
  - 999 Local Messages (criticals stored across reboots)
- ExtremeWare vendor MIBs (includes FDB, PoE, CPU, Memory MIBs) http://www.extremenetworks.com/services/documentation

Security
- Routing protocol MD5 authentication (see above)
- Secure Shell (SSH-2), Secure Copy (SCP-2) and SFTP client/server with encryption/authentication (requires export controlled encryption module)
- SNMPv3 user based security, with encryption/authentication (see above)
- RFC 1492 TACACS+
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 3579 RADIUS EAP support for 802.1x
- RADIUS Per-command Authentication
- Access Profiles on All Routing Protocols
- Access Policies for Telnet/SSH-2/SCP-2
- Network Login - 802.1x, web and MAC-based mechanisms
- IEEE 802.1x – 2001 Port-Based Network Access Control for Network Login
- Multiple supplicants with multiple VLANs for Network Login (all modes)
- Fallback to local authentication database (MAC and Web-based methods)
- Guest VLAN for 802.1x
- RFC 1866 HTML – Used for web-based Network Login
- SSL/TLS transport – used for for web-based Network Login, (requires export controlled encryption module)
- MAC Security – Lockdown and Limit
- IP Security – RFC 3046 DHCP Option 82 with port and VLAN ID
- IP Security – DHCP enforcement via Disable ARP Learning
- IP Security – Gratuitous ARP Protection
- IP Security – Trusted DHCP Server
- IP Security – DHCP Secured ARP / ARP Validation
- Layer 2/3/4 Access Control Lists (ACLs)

Denial of Service Protection:
- RFC 2267 Network Ingress Filtering
- RPF (Unicast Reverse Path Forwarding) Control via ACLs
- Wire-speed ACLs
- Rate Limiting / Shaping by ACLs
- IP Broadcast Forwarding Control
- ICMP and IP-Option Response Control
- SYN attack protection
- CPU DoS Protection with traffic rate-limiting to management CPU
- Robust against common Network Attacks:

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Technical Specifications

  - CERT (http://www.cert.org)
  - CA-2003-04: "SQL Slammer"
  - CA-2002-36: "SSHredder"
  - CA-2002-03: SNMP vulnerabilities
  - CA-98-13: tcp-denial-of-service
  - CA-98.01: smurf
  - CA-97.28:Teardrop_Land -Teardrop and "LAND" attack
  - CA-96.26: ping
  - CA-96.21: tcp_syn_flooding
  - CA-96.01: UDP_service_denial
  - CA-95.01: IP_Spoofing_Attacks_and_ Hijacked_ Terminal_Connections
  - IP Options Attack
- Host Attacks
  - Teardrop, boink, opentear, jolt2, newtear, nestea, syndrop, smurf, fraggle, papasmurf, synk4, raped, winfreeze, ping –f, ping of death, pepsi5, Latierra, Winnuke, Simping, Sping, Ascend, Stream, Land, Octopus

Summit X450e-24p

General Specifications

Performance

- 128 Gbps switch fabric bandwidth
- 65.5 Mpps frame forwarding rate
- 9216 Byte maximum packet size (Jumbo Frame)
- 128 load sharing trunks, up to 8 members per trunk
- 8 QoS queues/port
- 4096 VLANs (Port, Protocol, IEEE 802.1Q)
- 1,024 centralized ACL rules per switch

Forwarding Tables

- Layer 2/MAC Addresses: 8K
- IPv4 Host Addresses: 2K
- IPv4 LPM Entries: 512
- IPv6 Host Addresses: 1K
- IPv6 LPM Entries: 256

Rate Limiting

- Ingress bandwidth policing/rate limiting per flow
- Egress bandwidth rate limiting per egress queue
- Rate Limiting Granularity: 64Kbps
- Available Rate Limiters: 1,024 per switch

Indicators

- Per port status LED including power status
- System Status LEDs: management, fan and power

Ports

- 24 ports 10/100/1000BASE-T PoE with auto-speed and auto-polarity
- 4 ports SFP (mini-GBIC, shared PHY with 4 10/100/1000BASE-T ports)
- 1 port Serial (control port)
- 1 10/100BASE-T out-of-band management Port
- Per port status LED including power status

Option Slot

- Slot for XGM2 dual 10 gigabit option module

Physical Specifications

Dimensions

Height Inches/Cm: 1.73 Inches/4.4 Cm
Width Inches/Cm: 17.35 Inches/44.1 Cm
Depth Inches/Cm: 15.3 Inches/38.7 Cm
Weight Lbs/Kg: 14 lbs/6.35 Kg

EPS Dimensions

EPS-LD

Height: 1.73 Inches/4.4 Cm
Width: 17.4 Inches/44 Cm
Depth: 7.6 Inches/19.3 Cm

Operating Specifications

Temperature

- Operating Temperature Range: 0° C to 40° C (32° F to 104° F)
- Operating Humidity: 10% to 93% relative humidity, non-condensing
- Operational Shock (Half Sine): 30 m/s2 (3g), 11ms, 60 Shocks
- Operational Random Vibration: 3-500 MHz @ 1.5g rms

Storage & Transportation Conditions (Packaged)

- Transportation Temperature: -40° C to 70° C (- 40° F to 158° F)
- Storage and Transportation Humidity: 60% to 95% RH, non-condensing
- Packaged Shock (Half Sine): 180 m/s2 (18g), 6ms, 600 shocks
- Packaged Sine Vibration: 5-62 Hz @ Velocity 5mm/s, 62-500 Hz @ 0.2 G
- Packaged Random Vibration: 5-20 Hz @ 1.0 ASD w/-3dB/oct. from 20-200 Hz
- 14 drops min on sides & corners @ 42"(<15kg box)

Power & Acoustic Sound

- Voltage Input Range: 85 - 264V
- Nominal Input Current: 4.25A @ 115V~ (lowline) 2.5A @ 230V~ (high-line)
- Maximum In-Rush Current: 30A @115V/60 Hz, Max Load
- Efficiency: 80% with 60%-100% load
- Line Frequency Range: 47 - 63 Hz
- Nominal Frequency Range: 50 - 60 Hz
- Power Supply Input Socket: IEC 320 C14
- Power Cord Input Plug: IEC 320 C13
- Heat Dissipation: 120W
- Power Consumption: 500W
- Sound Power in accordance with EN 300 753 (10-1997)
- Sound Power: 62 dBA per ISO 7779
- Declared Sound Power: 6.4 belsA per ISO 7779 & ISO 9296
- Bystander Sound Pressure in accordance with NEBS GR-63 Issue 2
- Bystander Sound Pressure: 54 dBA right side @ .6m

External Power Supply - EPS-LD

- Voltage Input Range: 90 - 264V
- Nominal Input Voltage/Hz: 115V~/60Hz & 230V~/50Hz
- Line Frequency Range: 47 - 63 Hz
- Nominal Frequency Range: 50 - 60 Hz
- Maximum Input Current Rating: 10A at 115 VAC, 5A at 230 VAC
- Maximum Inrush Current: 30A at 115 VAC, 60A at 230 VAC
- Output: -50 VDC, 7.5A max, 375 Watts 12 VDC, 7.5A max, 90 Watts
- Power Supply Input Socket: IEC 320 C14
- Power Cord Input Plug: IEC 320 C13
- Maximum continuous DC output shall not exceed 465 Watts.

Regulatory/Safety Standards

North American Safety of ITE

- UL 60950-1:2003 1st Ed., Listed Device (U.S.)
- CSA 22.2#60950-1-03 1st Ed.(Canada)
- Complies with FCC 21CFR 1040.10 (U.S. Laser Safety)
- CDRH Letter of Approval (U.S. FDA Approval)
- IEEE 802.3af 6-2003 Environment A for PoE Applications

European Safety of ITE

- EN60950-1:2001
- EN 60825-1+A2:2001 (Lasers Safety)
- TUV-R GS Mark by German Notified Body
- 73/23/EEC Low Voltage Directive

International Safety of ITE

- CB Report & Certificate per IEC 60950-1:2001+All Country Deviations
- AS/NZX 3260 (Australia /New Zealand)

EMI/EMC Standards

North America EMC for ITE

- FCC CFR 47 part 15 Class A (U.S.A.)
- ICES-003 Class A (Canada)

European EMC standards

- EN 55022:1998 Class A
- EN 55024:1998 Class A includes IEC 61000-4-2, 3, 4, 5, 6, 8, 11
- EN 61000-3-2,3 (Harmonics & Flicker)
- ETSI EN 300 386:2001 (EMC Telecommunications)
- 89/336/EEC EMC Directive

International EMC Certifications

- CISPR 22:1997 Class A (International Emissions)
- CISPR 24:1997 Class A (International Immunity)
- •IEC/EN 61000-4-2 Electrostatic Discharge, 8kV Contact, 15kV Air, Criteria A
- IEC/EN 61000-4-3 Radiated Immunity 10V/m, Criteria A
- IEC/EN 61000-4-4 Transient Burst, 1kV, Criteria A
- IEC/EN 61000-4-5 Surge, 2kV L-L, 2kV L-G, Level 3, Criteria A
- IEC/EN 61000-4-6 Conducted Immunity, 0.15-80MHz, 10V/m unmod. RMS, Criteria A
- IEC/EN 61000-4-11 Power Dips & Interruptions, >30%, 25 periods, Criteria C

Country Specific

- VCCI Class A (Japan Emissions)
- AS/NZS 3548 ACA (Australia Emissions)
- CNS 13438:1997 Class A (BSMI-Taiwan)
- MIC Mark, EMC Approval (Korea)

Telecom Standards

- ETSI EN 300 386:2001 (EMC Telecommunications)
- ETSI EN 300 019 (Environmental for Telecommunications)
- IEEE 802.3 Media Access Standards
- IEEE 802.3ab 1000BASE-T
- IEEE 802.3z 1000BASE-X
- IEEE 802.3ae 10GBASE-X

Environmental Standards

- EN/ETSI 300 019-2-1 v2.1.2 - Class 1.2 Storage
- EN/ETSI 300 019-2-2 v2.1.2 - Class 2.3 Transportation

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Technical Specifications

- EN/ETSI 300 019-2-2 v2.1.2 - Class 2.3 Transportation
- EN/ETSI 300 019-2-3 v2.1.2 - Class 3.1e Operational
- EN/ETSI 300 753 (1997-10) - Acoustic Noise
- ASTM D3580 Random Vibration Unpackaged 1.5G

Summit X450e-48p

General Specifications

Performance

- 256 Gbps switch fabric bandwidth
- 101.2 Mpps frame forwarding rate
- 9216 Byte maximum packet size (Jumbo Frame)
- 128 load sharing trunks, up to 8 members per trunk
- 8 QoS queues/port
- 4096 VLANs (Port, Protocol, IEEE 802.1Q)
- 1,024 centralized ACL rules per 24-ports

Forwarding Tables

- Layer 2/MAC Addresses: 8K
- IPv4 Host Addresses: 2K
- IPv4 LPM Entries: 512
- IPv6 Host Addresses: 1K
- IPv6 LPM Entries: 256

Rate Limiting

- Ingress bandwidth policing/rate limiting per flow
- Egress bandwidth rate limiting per egress queue
- Rate Limiting Granularity: 64Kbps
- Available Rate Limiters: 1,024 per 24-port

Indicators

- Per port status LED including power status
- System Status LEDs: management, fan and power

Ports

- 48 ports 10/100/1000BASE-T PoE with auto-speed and auto-polarity
- 4 ports SFP (mini-GBIC, shared PHY with 4 10/100/1000BASE-T ports)
- 1 port Serial (control port)
- 1 10/100BASE-T out-of-band management Port
- Per port status LED including power status

Option Slot

- Slot for XGM2 dual 10 gigabit option module

Physical Specifications

Dimensions

Height Inches/Cm: 1.73 Inches/4.4 Cm
Width Inches/Cm: 17.35 Inches/44.1 Cm
Depth Inches/Cm: 17.0 Inches/43.2 Cm
Weight Lbs/Kg: 16.25 lbs/7.4 Kg

EPS Dimensions

EPS-C
Height: 1.73 Inches/4.4 Cm
Width: 17.4 Inches/44 Cm
Depth: 11.9 Inches/30.2 Cm

EPS-600LS
Height: 1.59 Inches/4.0 Cm
Width: 4.0 Inches/10.1 Cm
Depth: 10.4 Inches/26.4 Cm

Operating Specifications

Temperature

- Operating Temperature Range: 0° C to 40° C (32° F to 104° F)
- Operating Humidity: 10% to 93% relative humidity, non-condensing
- Operational Shock (Half Sine): 30 m/s2 (3g), 11ms, 60 Shocks
- Operational Random Vibration: 3-500 MHz @ 1.5g rms

Storage & Transportation Conditions (Packaged)

- Transportation Temperature: -40° C to 70° C (- 40° F to 158° F)
- Storage and Transportation Humidity: 60% to 95% RH, non-condensing
- Packaged Shock (Half Sine): 180 m/s2 (18g), 6ms, 600 shocks
- Packaged Sine Vibration: 5-62 Hz @ Velocity 5mm/s, 62-500 Hz @ 0.2 G
- Packaged Random Vibration: 5-20 Hz @ 1.0 ASD w/-3dB/oct. from 20-200 Hz
- 14 drops min on sides & corners @ 42"(<15kg box)

Power & Accoustic Sound

- Voltage Input Range: 85 – 264V
- Nominal Input Current: 5.25A @ 100V~ (lowline) 2.5A @ 230V~ (high-line)
- Maximum In-Rush Current: 30A @115V/60 Hz, Max Load
- Efficiency: 80% with 60%-100% load
- Line Frequency Range: 47 – 63 Hz
- Nominal Frequency Range: 50 - 60 Hz
- Power Supply Input Socket: IEC 320 C14
- Power Cord Input Plug: IEC 320 C13
- Heat Dissipation: 180W
- Power Consumption: 603W
- Sound Power in accordance with EN 300 753 (10-1997)
- Sound Power: 62 dBA per ISO 7779
- Declared Sound Power: 6.4 belsA per ISO 7779 & ISO 9296
- Bystander Sound Pressure in accordance with NEBS GR-63 Issue 2
- Bystander Sound Pressure: 54 dBA right side @ .6m

External Power Supply - EPS-600LS

- Voltage Input Range: 85 - 264 V
- Nominal Input Voltage/Hz: 115V~/60Hz & 230V~/50Hz
- Line Frequency Range: 47 – 63 Hz
- Maximum Input Current Rating: 6.75A at 115 VAC, 3.25A at 230 VAC
- External Power Supply-EPS-C Chassis accepts up to three EPS-600LS power modules and provides the following capability depending upon the number of EPS-600LS installed
  - One EPS-600LS
    - Redundant, up to 370W PoE power
  - Two EPS-600LS
    - Non-Redundant, up to 740W PoE power
  - Three EPS-600LS
    - Redundant, up to 740W PoE power

Regulatory/Safety Standards

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- ASTM D3580 Random Vibration Unpackaged 1.5G

Warranty

- Limited Lifetime Hardware Warranty
- 90-days on Software

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Ordering Information

Part Number	Name	Description
16142	Summit X450e-24p	24 10/100/1000BASE-T with PoE, 4 unpopulated mini-GBIC ports, option slot for 10 gigabit option card XGM2-2xn/xf, 1 AC PSU, ExtremeXOS Edge License, connector for EPS-LD external redundant PSU
16143	Summit X450e-24p Advanced Edge License	ExtremeXOS Advanced Edge License, Summit X450e-24p
16148	Summit X450e-48p	48 10/100/1000BASE-T with PoE, 4 unpopulated mini-GBIC ports, option slot for 10 gigabit option card XGM2-2xn/xf, 1 AC PSU, ExtremeXOS Edge License, connector for EPS-C external power system chassis (Requires EPS-600LS)
16149	Summit X450e-48p Advanced Edge License	ExtremeXOS Advanced Edge License, Summit X450e-48p
16112	XGM2-2xf	Option card, two unpopulated 10 gigabit XFP slots, compatible with Summit X450e, and Summit X450a
16113	XGM2-2xn	Option card, two unpopulated 10 gigabit XENPAK slots, compatible with Summit X450e and Summit X450a
45019	EPS-LD	External Power Supply Unit
10912	EPS-C	External Power Supply Unit, with cable. Accepts up to three EPS-600LS power modules
10913	EPS-600LS	External Power System Power Module for EPS-C, 600 Watts
10110	SR XENPAK	10GBASE-SR XENPAK Transceiver, 850 nm, up to 300 m on Multimode Fiber, SC Connector
10111	LR XENPAK	10GBASE-LR XENPAK Transceiver, 1310 nm, up to 10 km on Single-mode Fiber, SC Connector
10112	ER XENPAK	10GBASE-ER XENPAK Transceiver, 1550 nm, up to 40 km on Single-mode Fiber, SC Connector
10113	ZR XENPAK	10GBASE-ZR XENPAK Transceiver, 1550 nm, up to 80 km on Single-mode Fiber, SC connector
10114	LX4 XENPAK	10GBASE-LX4 XENPAK Transceiver, 1310 nm, up to 300 m on Multi-mode Fiber and up to 10 km on a Single-mode Fiber, SC Connector
10121	SX XFP	10GBASE-SR XFP Transceiver, 850nm, up to 300m on Multimode Fiber, LC Connector
10122	LR XFP	10GBASE-LR XFP Transceiver, 1310nm, up to 10km on Single-mode Fiber, LC Connector
10051	SX mini-GBIC	1000BASE-SX Mini-GBIC, SFP, 1000BASE-SX, LC Connector
10052	LX mini-GBIC	1000BASE-LX Mini-GBIC, SFP, 1000BASE-LX, LC Connector
10053	ZX mini-GBIC	1000BASE-ZX Mini-GBIC, SFP, Extra Long Distance SMF 70 km/21 dB Budget, LC Connector
10056	1000BX mini-GBIC BX-D	1000BASE-BX-D Mini-GBIC, SFP, SMF (1490 nm TX/1310 nm RX Wavelength)
10057	1000BX mini-GBIC BX U	1000BASE-BX-U Mini-GBIC, SFP, SMF (1310-nm TX/1490-nm RX Wavelength)

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